

# Description

## [Insert for Golf Club Head]

### CROSS REFERENCE TO RELATED APPLICATIONS

[0001] Not Applicable

### FEDERAL RESEARCH STATEMENT

[0002] [Not Applicable]

### BACKGROUND OF INVENTION

[0003] Field of the Invention

[0004] The present invention relates to a golf club head with an insert. More specifically, the present invention relates to a putter head with a polymer insert.

[0005] Description of the Related Art

[0006] Throughout the history of golf, which dates back to as early as 1457, various techniques have been used to enhance the hitting characteristics of golf club heads. Golf club heads having inserts for the striking portion have been used at least as far back as 1880's when leather face

irons were manufactured in Scotland. Golfer's in the 1890's were able to purchase putters with faces composed of gutta percha. More recently, inserts composed of various materials and shapes have been put forth by the creative geniuses of the golf industry to provide golfers with better feel and control of the golf ball.

[0007] One example is an ODYSSEY®DUAL FORCE®putter having a STRONOMIC® insert that is disclosed in Magerman et al., U.S. Patent Number 5,575,472 for a Golf Putter Head Having Face Insert And Method Of Forming The Same. The Magerman et al. Patent discloses a putter head with a recess into which is poured or inserted a resinous material which cures and is subsequently milled to produce the putter.

[0008] Another example is an ODYSSEY®WHITE HOT®putter having an insert composed of a polyurethane material. The ODYSSEY®WHITE HOT® putter is disclosed in U.S. Patent Number 6,238,302 for a Golf Club Head With An Insert Having Integral Tabs.

[0009] Another example is Pond, U.S. Patent Number 5,524,331 for a Method For Manufacturing Golf Club Head With Integral Inserts that discloses a method for casting a graphite-epoxy composite insert within a recess of a face

of a metal club head. The golf club head of the Pond Patent is directed at displacing the weight away from the center and increasing the moment of inertia.

[0010] Another example is Schmidt et al., U.S. Patent Number 5,485,997, for a Golf Putter Head With Face Plate Insert Having Heightened Medial Portion, that discloses a putter head with a face plate composed of a non-metallic material such as an elastomer. The overall construction of the putter head of the Schmidt et al. Patent is directed at enlarging the sweet spot and improving the peripheral weighting.

[0011] Yet another example is found in Baker et al., U.S. Patent Number 5,931,743 for a Putter Having Club Head With A Golf-Ball Engagement Insert And A Shaft Rearwardly Of The Insert which discloses a putter with a center shaft and an insert composed of a thermoplastic polyurethane. Another example is Jepson et al., U.S. Patent Number 3,937,474 for a Golf Club With Polyurethane Insert, which discloses a wood having an insert on its striking face that is composed of a polyurethane formed from a tolylene diisocyanate polyether terminated prepolymer and a curing agent. The hardness of this insert varies from 40 to 75 shore D, and a Bashore Resiliometer of 17 or above. The

polyurethane insert is claimed to impart additional energy to the golf ball during a golf hit.

[0012] Chen et al., U.S. Patent number 5,743,813 for a Golf Club Head discloses a wood composed of stainless steel with a three layer face having a first stainless steel layer, an elastic layer and a second stainless steel layer. The three-layer face does not absorb the hitting force when a golf ball is hit.

[0013] Fisher, U.S. Patent Number 5,458,332, for a Golf Putter Head With A Cushioning Face, discloses a set of golf putters, each having an insert composed of polyurethane with a hardness in the range of 70 Shore A to about 80 Shore D. The rebound factor of each of the inserts is in the range of 12.5% to 50%, and the inserts are formulated to effect a reproducible direct linear relationship between the rebound factor and the distance of the putt.

[0014] Yet another example is McGeeney et al, European Patent Application Number 0891790 for a Multiple Density Golf Club Head And Method Of Manufacturing which discloses a putter with a central segment composed of a thermoplastic elastomer or a thermoset polymer. Possible thermoplastic elastomers include styrene co-polymers, copolyesters, polyurethanes, polyamides, olefins and vul-

canates. Possible thermoset polymers include epoxides, polyimides and polyester resins. The central segment has a minimum durometer hardness of Shore D 50. The central segment is bounded by metallic heel and to portions. However, the use of inserts is restrained in order to maintain the integrity of the game of golf.

[0015] In this regard, the Rules of Golf, established and interpreted by the United States Golf Association ("USGA") and The Royal and Ancient Golf Club of Saint Andrews, sets forth certain requirements for a golf club head. The requirements for a golf club head are found in Rule 4 and appendix II. A complete description of the Rules of Golf are available on the USGA web page at [www.usga.org](http://www.usga.org). Although the Rules of Golf do not expressly state specific parameters for an insert for a putter, the Rules of Golf have been interpreted to establish that an insert for a putter should have a Shore A hardness greater than  $87 \pm 2\%$ , have a constant thickness, have a thickness of at least 0.125 inches, and not act like a spring.

[0016] Issues with the inserts of the prior art include complex processing, yellowing of polyurethane materials, and deformation under extended high temperatures.

## **SUMMARY OF INVENTION**

[0017] The present invention provides an insert for a golf club head that is easy to manufacture, non-yellowing, and has outstanding heat deflection. The present invention is able to accomplish this by providing an insert composed of a thermoplastic polyurethane material formed from a poly-tetramethylene ether glycol terminated hexamethylene diisocyanate prepolymer and a 1, 4 butane diol.

[0018] One aspect of the present invention is a golf club head including a club head body and a an insert. The club head body has a front face with a recess therein. The insert is disposed within the recess. The insert includes a body with an exterior surface, an interior surface and a perimeter defining the thickness of the body. The insert is composed of a thermoplastic polyurethane material formed from a polytetramethylene ether glycol terminated hexamethylene diisocyanate prepolymer and a 1, 4 butane diol, wherein the insert has a Shore D hardness ranging from 50 to 65.

[0019] Having briefly described the present invention, the above and further objects, features and advantages thereof will be recognized by those skilled in the pertinent art from the following detailed description of the invention when taken in conjunction with the accompanying drawings.

## **BRIEF DESCRIPTION OF DRAWINGS**

- [0020] FIG. 1 is a perspective view of one embodiment of the golf club head of the present invention without an insert in the recess of the club head body.
- [0021] FIG. 1A is a front view of the club head of FIG. 1 with the insert placed therein.
- [0022] FIG. 1B is a side view of the club head of FIG. 1.
- [0023] FIG. 1B is a rear view of the club head of FIG. 1.
- [0024] FIG. 1D is a top view of the club head of FIG. 1.
- [0025] FIG. 2 is a front view of another embodiment of the golf club head of the present invention with an insert in the recess of the club head body.
- [0026] FIG. 2A is a partial cross-sectional side view of the club head of FIG. 2.
- [0027] FIG. 2B is a rear view of the club head of FIG. 2.
- [0028] FIG. 2C is a top view of the club head of FIG. 2.
- [0029] FIG. 3 is a front view of another embodiment of the golf club head of the present invention with an insert in the recess of the club head body.
- [0030] FIG. 3A is a side view of the club head of FIG. 3.
- [0031] FIG. 3B is a rear view of the club head of FIG. 3.

- [0032] FIG. 3C is a top view of the club head of FIG. 3.
- [0033] FIG. 4 is a front view of another embodiment of the golf club head of the present invention with an insert in the recess of the club head body.
- [0034] FIG. 4A is a side view of the club head of FIG. 4.
- [0035] FIG. 4B is a rear view of the club head of FIG. 4.
- [0036] FIG. 4C is a top view of the club head of FIG. 4.
- [0037] FIG. 5 is a front view of another embodiment of the golf club head of the present invention with an insert in the recess of the club head body.
- [0038] FIG. 5A is a side view of the club head of FIG. 5.
- [0039] FIG. 5B is a rear view of the club head of FIG. 5.
- [0040] FIG. 5C is a top view of the club head of FIG. 5.
- [0041] FIG. 6 is a front view of another embodiment of the golf club head of the present invention with an insert in the recess of the club head body.
- [0042] FIG. 6A is a partial cross-sectional side view of the club head of FIG. 6.
- [0043] FIG. 6B is a rear view of the club head of FIG. 6.
- [0044] FIG. 6C is a top view of the club head of FIG. 6.



- [0045] FIG. 7 is a front view of a wood club head with an insert of the present invention.
- [0046] FIG. 8 is a front view of an iron club head with an insert of the present invention.
- [0047] FIG. 9 is an isolated perspective view of one embodiment of the insert of the present invention.
- [0048] FIG. 9A is an enlarged view of circle A of FIG. 9.
- [0049] FIG. 10 is a front view of the insert of FIG. 9.
- [0050] FIG. 10A is an enlarged view of circle A of FIG. 10.
- [0051] FIG. 10B is a cross-sectional view of the insert of FIG. 10 along lines B-B.
- [0052] FIG. 10C is an enlarged view of circle C of FIG. 10B.
- [0053] FIG. 11 is an isolated perspective view of an alternative embodiment of the insert of the present invention.
- [0054] FIG. 11A is an enlarged view of circle A of FIG. 11.
- [0055] FIG. 12 is a front view of the insert of FIG. 11.
- [0056] FIG. 12A is a cross-sectional view of the insert of FIG. 12 along lines A-A.
- [0057] FIG. 12B is an enlarged view of circle B of FIG. 12.
- [0058] FIG. 12C is an enlarged view of circle C of FIG. 12A.

[0059] FIG. 13 is a front view of an alternative embodiment of the insert of the present invention.

[0060] FIG. 13A is an enlarged view of circle A of FIG. 13.

[0061] FIG. 13B is a cross-sectional view of the insert of FIG. 13 along lines B-B.

[0062] FIG. 13C is a perspective view of the insert of FIG. 13.

[0063] FIG. 14 is an isolated front view of an insert disposed within a recess of the face of a golf club head of the present invention.

[0064] FIG. 14A is an enlarged view of the circle A of FIG. 14.

[0065] FIG. 14B is an isolated view of the insert within the recess of the club head, and bonded to the recess wall by an epoxy.

[0066] FIG. 15 is a front view of a putter of the present invention.

[0067] FIG. 16 is a top perspective another embodiment of the golf club head of the present invention with an insert in the recess of the club head body.

[0068] FIG. 17 is a front view of the golf club head of FIG. 16.

[0069] FIG. 18 is a side view of the golf club head of FIG. 16.

[0070] FIG. 19 is a top view of the golf club head of FIG. 16.

[0071] FIG. 20 is a bottom view of the golf club head of FIG. 16.

## DETAILED DESCRIPTION

[0072] As shown in FIGS. 1 through 1D, a putter of the present invention is generally designated 50. The putter 50 includes a club head 52 having a body 54 with a front face 56 with a recess 58 therein. The club head 52 of the present invention also includes an insert 60 disposed within the recess 56. The insert 60 extends along most of the face 56 from a heel 62 of the club head 52 to a toe 64 of the club head 52, and from a sole 66 of the club head 52 to a crown 68 of the club head 52. The club head 52 also has a hosel 70 for connection to a shaft 72. Opposite of the front face 56 of the club head 52 is a rear 74 of the club head 52.

[0073] The body 54 of the club head 52 is preferably composed of a metallic material such as stainless steel. Other metallic materials include titanium, aluminum, tungsten, zinc, magnesium, and alloys of stainless steel and tungsten. However, those skilled in the pertinent art will recognize that the body 54 may be composed of other materials without departing from the scope and spirit of the present invention. Further, the non-insert portion of the face 56 may be smooth or textured to provide a consistent or non-consistent surface with the exterior surface of the in-

sert. Additionally, the body 54 may be specifically weighted to provide a specific center of gravity and inertial properties for the putter 50.

[0074] FIGS. 2–6C illustrate various embodiments of putters 50 of the present invention. Each of the putters 50 of FIGS. 2–6C has a club head 52 with a body 54 and an insert 60 disposed within a recess 58 of the body 54. The putters 50 illustrated in FIGS. 1–6C are flanged blade, mallet and semi-mallet putters, however, those skilled in the art will recognize that other similar putter designs may be utilized without departing from the scope and spirit of the present invention. In a preferred embodiment, each of the club heads 52 weigh approximately 328 grams  $\pm$ 7 grams. Further, in a preferred embodiment, the recess 58 of each of the club heads 52 has a depth of approximately 0.205 inches  $\pm$ 0.010 inches.

[0075] Referring specifically to FIG. 1, the recess 58 of the body 54 is defined by a recess face wall 80 which is substantially parallel with the insert 60, and a recess edge wall 82 which is substantially perpendicular to the recess face wall 80. The recess face wall 80 defines the depth of the recess 58 that will determine the thickness of the polymer insert 60. The recess edge wall 82, as shown in FIG.1, is

composed of a bottom recess edge wall 82a, a heel recess edge wall 82b, a top recess edge wall 82c and a toe recess edge wall 82d. The recess edge wall 82 defines the shape of the recess 58, and the length of the recess edge wall 82 is determined by the depth of the recess 58. In a preferred embodiment, the insert 60 will engage the recess edge wall 82 as described below.

[0076] The putter 50 of FIGS. 1–1D is a flanged blade style putter. The rear 74 of the club head 52 has a rear wall 75 and a flanged portion 77. The insert 60 of this embodiment occupies approximately 67.90% of the face area of the club head 52. The insert 60 also occupies approximately 20.71% of the volume of the club head 52. Yet further, the insert 60 of this embodiment is approximately 3.95% of the weight of the club head 52.

[0077] The putter 50 of FIGS. 2–2C is also a blade style putter, however, it has an offset hosel 70, and an insert 60 with a panhandle portion 60a. The insert 60 is one-piece, including the panhandle portion 60a. It is apparent from FIG. 2 that this putter 50 has a larger area of the non-insert portion of the face 56 than the embodiment shown in FIG. 1A. The insert 60 of this embodiment occupies approximately 69.22% of the face area of the club head 52.

The insert 60 also occupies approximately 20.33% of the volume of the club head 52. Yet further, the insert 60 of this embodiment is approximately 3.86% of the weight of the club head 52.

[0078] The putter 50 of FIGS. 3–3C is a half-mallet style putter with an offset hosel 70. The insert 60 has a trapezoidal shape with parallel sides and a curved bottom portion. It is apparent from FIG. 3 that the toe end and heel end of the face 56 of this putter 50 has a large area of the non-insert portion. The insert 60 of this embodiment occupies approximately 68.27% of the face area of the club head 52. The insert 60 also occupies approximately 17.15% of the volume of the club head 52. Yet further, the insert 60 of this embodiment is approximately 3.08% of the weight of the club head 52.

[0079] The putter of FIGS. 4–4C is a mallet style putter, however, it does not have an offset hosel 70. The insert 60 of this embodiment occupies the largest amount of the face area of the club head 52, approximately 70.38%. However, the insert 60 occupies the smallest volume of the club head 52, approximately 16.24%. Yet further, the insert 60 of this embodiment is the lightest, weighing approximately 2.46% of the club head 52.

[0080] The putter 50 of FIGS. 5–5C is a flanged–blade style putter with an offset hosel 70. The insert 60 has a trapezoidal shape with parallel sides and a curved bottom portion. It is apparent from FIG. 5 that the toe end and heel end of the face 56 of this putter 50 has a non–insert portion larger than any of the other embodiments. The insert 60 of this embodiment only occupies approximately 59.82% of the face area of the club head 52. The insert 60 also occupies approximately 18.43% of the volume of the club head 52. Yet further, the insert 60 of this embodiment is approximately 3.42% of the weight of the club head 52. The putter of FIGS. 6–6C is a blade style putter. As shown in FIG. 6A, the polymer 60 only occupies a small portion of the volume of the club head 52 compared to the body 54 of the club head 52.

[0081] The inserts 60 of FIGS. 1–6C vary in shape and thickness depending on the design of the putter 50. A preferred shape of the insert 60 is a trapezoidal shape with curved corners. An alternative shape is a trapezoidal shape with a panhandle as illustrated in FIG. 2. The weight of the insert 60 may be adjusted, and may vary in a range of 1.0%–5% of the weight of the club head 52. Further, the volume of the insert 60 may vary between 10% and 25% of the vol–

ume of the club head 52. Additionally, the percentage of the face area occupied by the insert 60 may vary between 55% and 75% of the total area of the face 56.

[0082] FIG. 7 illustrates yet another utilization of the insert 60a in a wood club head 52a. The insert 60a occupies most of the face 56a, from the heel 62a to the toe 64a, and from the sole 66a to the crown 68a. The body 54a of the club head 52a may be hollow, unlike the putters 50 of the previous embodiments. Further, the recess face wall, not shown, of the recess 58a will not abut the rear wall, not shown, unlike the putters 50 of the previous embodiments. The body 54a may be composed of titanium, or steel. FIG. 8 illustrates a further embodiment where the insert 60b is used on the face 56b of an iron club head 52b.

[0083] FIGS. 16–20 illustrate an extended mallet type putter-type golf club head 20 with an alignment system such as disclosed in U.S. Patent Number 6,471,600, which relevant parts are hereby incorporated by reference.

[0084] FIGS. 9–10C illustrate isolated views of one embodiment of the insert 60 of the present invention. The insert 60 has a plurality of tabs 100 spaced substantially equidistant apart. In a preferred embodiment, the distance "d" is



0.41 inches. However, those skilled in the pertinent art will recognize that the value of d may be adjusted for various embodiments. The plurality of tabs 100 lie on a perimeter 120 of the insert 60. The perimeter defines the thickness of the insert 60. A preferred thickness is 0.198 inches, however the thickness may preferably range from 0.125 to 0.50 inches. The insert 60 has an interior surface 124 and an exterior surface 122. The interior surface 124 faces the recess face wall 80 while the exterior surface 122 forms a portion of the face 56 of the club head 52.

[0085] In a preferred embodiment, each of the plurality of tabs 100 is composed of a curved portion 130 and a straight portion 132. The straight portion 132 projects from the perimeter 120 and becomes the curved portion 130. The curved portion 132 engages with the recess edge wall 82 of the recess 58 of the club head 52. An undercut 134 is formed between the curved portion 130 and the perimeter 120 on the exterior surface 122 side of the insert 60. The undercut 134 is cut from the straight portion 132 thereby creating a straight portion 132 that does not extend along the entire width of the perimeter 120. Further, the curved portion 130 does not extend along the entire width of the perimeter 120, terminating just prior to the exterior sur-

face 122. However, the curved portion 130 does extend further than the straight portion 132. The height "h" of the undercut 134 is preferably 0.01 inches, however it may range from 0.005 inches to 0.025 inches. Each of the plurality of tabs 100 is compressible for engagement of the insert 60 into the recess 58 of the club head 52. As described below, an adhesive is filled between the tabs 100 and into the undercuts 134 when the insert 60 is mounted in the recess 58 of the club head 52.

[0086] FIGS. 11–12C illustrate isolated views of a different embodiment of the insert of the present invention. The insert 60 of FIGS. 11–12C has different shape than the insert 60 of FIGS. 9–10C.

[0087] FIGS. 13–13C illustrate yet another embodiment of the insert 60 of the present invention. In this embodiment, each of the plurality of tabs 100a has a hemispherical shape with an undercut 134a on the exterior surface 122 side of the insert 60.

[0088] FIGS. 14–14B illustrate the attachment of the polymer insert 60 to the club head 54. The plurality of tabs 100 hold the insert in place, allowing it to float while the adhesive cures. The plurality of tabs 100 allow for precise depth placement of the insert within the recess. Such precision

is not available in the prior art. Further, the ability of the insert 60 to float due to the plurality of tabs 100 also eliminates a tooling step in the manufacture of the club head of the present invention. As shown in FIGS. 14–14B, the polymer insert 60 is held within the recess 58 by the tabs 100 on the perimeter of the insert 100, an adhesive 102 applied into the spacings between the tabs 100, and an adhesive 104 applied to the recess frontal wall 80 and/or the interior surface 124 of the insert 60. In a preferred embodiment illustrated in FIG. 15, the adhesive 102 is applied along the entire perimeter 120, not shown, of the insert 60 thereby covering each of the plurality of tabs 100. A preferred adhesive is DP460 epoxy adhesive from 3M of Minneapolis, Minnesota. Other possible epoxies are JET WELD® urethane epoxy, and DP270, both available from 3M. Other adhesives may be utilized in practicing the present invention, however, the thermal coefficient of the adhesive should be applicable to manufacturing, distributing and playing temperatures of club heads.

[0089] In a preferred embodiment, the insert 60 is composed of a thermoplastic polyurethane material, preferably an injection moldable thermoplastic polyurethane. The preferred polyurethane prepolymers are polytetramethylene ether

glycol terminated hexamethylene diisocyanate prepolymers available from Uniroyal Chemical under the trade-name ADIPRENE® LFH750, ADIPRENE® LFH749 and ADIPRENE® LFH720, which are aliphatic polyurethane prepolymers. The NCO content of the polytetramethylene ether glycol terminated hexamethylene diisocyanate prepolymer is preferably in the range of 8.0% to 12.0%, more preferably in the range of 10.0% to 11.5%, and most preferably 11%.

[0090] The prepolymer is preferably cured with a 1, 4 butane diol.

[0091] A colorant material, such as, for example, titanium dioxide, barium sulfate, and/or zinc oxide in a glycol or castor oil carrier, and/or other additive material(s) as are well known in the art, may be added to polyurethane precursor mixture. The amount of colorant material added is preferably in the range of about 0–10% by weight of the combined polyurethane prepolymer and curative materials, and more preferably in the range of about 2–8%.

[0092] The Shore D hardness of the thermoplastic polyurethane material for the insert 60 preferably ranges from 40 to 70 Shore D, more preferably from 50 to 65 Shore D, and is most preferably approximately 60 Shore D.

[0093] The thickness of the insert 60 may vary depending on its application. A preferred thickness for a putter 50 is in the range of 0.125 to 0.500 inch. A more preferred range of thickness is 0.188 inch to 0.200 inch. A most preferred thickness is 0.198 inch. The thickness of the insert 60 is increased or decreased to influence the feel to the golfer during impact with a golf ball.

[0094] Tables One, Two and Three illustrate the ultraviolet light stability of the polymer insert of the present invention. Tables One, Two and Three compare the polymer of the present invention and other like polymer materials. E1 and E2 are the polymer inserts of the present invention. CE1 and CE2 are Hytrel materials. CE3 and CE4 are Estane materials. CE5 and CE6 are Hytrel materials. Table One illustrates the results prior to exposure. Table Two illustrates the results after 48 hours of exposure. Table Three illustrates the differences. DE is the combined differences.

Table One

Example	L	a*	b*
E1	95.83	-7.5	16.32
E2	95.6	-7.38	16.33
CE1	95.9	-6.87	19.64
CE2	94.24	-6.6	21.25
CE3	94.5	-7.52	15.22
CE4	93.52	-7.47	15.23
CE5	94.45	-7.17	16.35
CE6	94.69	-7.17	16.41

Table Two

Example	L	a*	b*
E1	95.81	-7.42	16.41
E2	95.6	-7.46	16.25
CE1	92.32	-3.96	29.58
CE2	91.6	-3.74	29.66
CE3	92.85	-7.11	20.83
CE4	90.81	-6.55	24.31
CE5	93.82	-7.17	18.19
CE6	93.84	-7.18	18.17

Table Three

Example	L	a*	b*	DE
E1	-0.02	0.08	0.09	0.12
E2	0.00	-0.08	-0.08	0.11
CE1	-3.58	2.91	9.94	10.96
CE2	-2.64	2.86	8.41	9.27
CE3	-1.65	0.41	5.61	5.86
CE4	-2.71	0.92	9.08	9.52
CE5	-0.63	0.00	1.84	1.94
CE6	-0.85	-0.01	1.76	1.95

[0095] The inserts were measured to determine the yellowing of

the material after exposure to ultraviolet to simulate exposure to sunlight. The color of the inserts was determined using a HUNTER COLORIMETER model ULTRA SCAN XE and measuring the color on a L.a. b. scale. On the "L" scale, a measurement of 100 corresponds to complete white while a measurement of 0 corresponds to complete black. On the "a" scale, a negative number corresponds to a green color while a positive number corresponds to a red color. On the "b" scale, a negative number corresponds to a blue color while a positive number corresponds to a yellow color. Thus, the more positive the b measurement, the more yellow the insert.

[0096] As shown in Table Three, the insert of the present invention has almost complete ultraviolet light stability while inserts of the comparative examples vary greatly after 48 hours of exposure to ultraviolet light.